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NOTES AND LITERATURE

MUTATIONS IN *DROSOPHILA BUSCKII* COQ.¹

Two mutations in eye color have appeared in my cultures of *Drosophila busckii*. These mutations are of especial interest in that, as far as the writer has been able to learn, they are the first that have been recorded in this species. This is the eighth species of *Drosophila* in which mutations have been recorded, the other seven being *ampelophila*, *repleta*, *confusa*, *tripunctata*, *virilis*, *obscura*, and *similis*.

The eye mutant which is brighter than normal has been called "red" and the other which is darker than normal has been called "chocolate." The normal eye of this species is darker than that of *Drosophila ampelophila*. The mutant red corresponds very closely to the normal eye color of *ampelophila* except that it is slightly brighter. Ridgeway's "scarlet" (Plate I, color number 5, Ridgeway's Color Standards and Nomenclature, 1912) corresponds most nearly to the eye color of this mutant. In the red eye the central fleck shows as a small round point, while in the normal *busckii* eye, it appears larger and less definite in shape. The red eye darkens with age and closely approaches the normal eye in color, but at its darkest stage it can be distinguished from the normal in that it is less translucent. The chocolate eye is an opaque brown and presents none of the shiny appearance of the normal eye. The central fleck is invisible in newly emerged flies, but becomes more or less distinct as the fly ages. With age the color approaches normal, but always remains slightly darker. Flies over forty-eight hours old so nearly approach normal that they are difficult to distinguish. A newly emerged chocolate corresponds most nearly to Ridgeway's "chestnut brown" (Plate XIV, color number 11, tone m).

The mutation red eye was first observed in November, 1916, and it seems probable that the original mutation occurred somewhat earlier and was overlooked as several red-eyed flies, both males and females, were obtained from this cross. The original stock had been collected about a month earlier in a tomato patch

¹From the Zoological Laboratory of Indiana University, Contribution No. 157.

near Bloomington, Indiana, and had been bred in the laboratory for two generations.

The mutation chocolate eye was first observed in December, 1916, and here again the original mutation had probably been overlooked as in the cross where the mutation was first observed, several chocolate males and females appeared. The original stock in which this mutation appeared had been bred in the laboratory for three generations and was collected in the same tomato patch where the original red eye stock was collected. The stock in which the red eye appeared was collected on September 19, 1916, and the stock in which the chocolate eye appeared was collected September 14 of the same year and these stocks had been bred as two separate strains when the mutations appeared.

THE GENETIC BEHAVIOR OF RED EYE

Some of the first observed red males were mated to virgin red females and the offspring of this cross were all red flies. This red stock has been kept going for several generations and has given all typical reds. Both red males and red females were crossed with normal wild flies and in F_1 of each cross nothing but normal flies were found. Table I gives the results of the F_2 of these crosses.

TABLE I
 F_2 OF RED $\times$ WILD CROSS
Red ♀ $\times$ *Wild* ♂

Culture Number	Type of Mating	Normal		Red		Total Normal	Total Red
		♂	♀	♂	♀		
332.....	1 pair	317	322	125	119	639	244
333.....	" "	305	313	109	107	618	216
334.....	" "	275	282	100	98	557	198
335.....	" "	326	299	97	101	625	198
336.....	Mass	557	552	112	150	1,109	262
Total.....		1,780	1,768	543	575	3,548	1,118

Red ♂ $\times$ *Wild* ♀

337.....	1 pair	340	326	101	105	666	206
338.....	" "	269	293	79	88	562	167
339.....	" "	231	253	71	83	484	154
340.....	" "	244	250	59	86	494	145
341.....	Mass	469	466	87	100	935	187
342.....	"	265	228	90	93	493	183
Total.....		1,818	1,816	487	555	3,634	1,042
Grand total.....		3,598	3,584	1,030	1,130	7,182	2,160

It can be readily seen that the red eye acts as a non-sex-linked recessive character with the red class falling a little short. Shortage of the mutational class frequently occurs. It seems to make no difference whether the red male or red female is used in the cross. In most cases when mass cultures were made, the expected 3 to 1 ratio was less nearly approximated. The ratio of all the flies examined in the F_2 was 3.32 normals to 1 red.

THE GENETIC BEHAVIOR OF CHOCOLATE EYE

A pure stock of chocolate was obtained by mating some of the first observed chocolate males to their virgin chocolate sisters. This stock has bred true for several generations but since the eye changes so rapidly to a color approximating normal, in stocks where the flies are allowed to become more than twenty-four hours old, all gradations between the typical chocolate and normal will be found. The chocolate males and females were bred to wild normals and the F_1 flies were all normal. The results of the F_2 of these crosses are shown in Table II.

TABLE II
 F_2 OF CHOCOLATE $\times$ WILD CROSS
Chocolate ♀ $\times$ *Wild* ♂

Culture Number	Type of Mating	Normal		Chocolate		Total Normal	Total Chocolate
		♂	♀	♂	♀		
402.....	1 pair	263	212	43	95	475	138
403.....	" "	154	146	49	60	300	109
405.....	" "	223	181	57	109	404	166
406.....	Mass	529	468	67	136	997	203
Total.....		1,169	1,007	216	400	2,176	616

Chocolate ♂ $\times$ *Wild* ♀

408.....	1 pair	257	252	58	66	509	124
409.....	" "	238	242	45	61	480	106
411.....	" "	343	312	58	82	655	140
412.....	" "	83	67	17	17	150	34
413.....	Mass	812	667	78	161	1,479	239
414.....	"	426	440	106	133	866	239
Total.....		2,159	1,980	362	520	4,139	882
Grand total.....		3,328	2,987	578	920	6,315	1,498

Chocolate eye also acts as a non-sex-linked recessive character with the chocolate class falling considerably below the expected

number. The number of chocolate males, especially, falls low. The totals seem to indicate that this low number of chocolate males in comparison to the number of normal males is partially due to the fact that some of the chocolate males have been called normal, for in practically all of the matings, the number of normal males exceeds the number of normal females. This is unusual, for the writer has examined large numbers of wild *Drosophila busckii* and in a large majority of the cases the number of females has been equal to or greater than the number of males. So it may be that the males approximate the normal color more rapidly than the females and since the flies were examined only once a day, some of the chocolate males were mistaken for normals. Some counts were made, examining the flies twice a day, to test this supposition and they indicated that better ratios could be obtained in this manner. But since the work was completed before this was realized, the difference to be obtained by twice-a-day counts was not thought to be of sufficient importance to require the repetition of the experiments. Also in these matings, the relative number of chocolates was lower where mass cultures were made. The ratio for all of the F_2 flies examined was 4.21 normals to 1 chocolate.

THE GENETIC BEHAVIOR OF RED AND CHOCOLATE WHEN THEY ARE
MATED TOGETHER

Red males were crossed to chocolate females and red females to chocolate males and in the F_1 of each cross nothing but normal flies appeared. The results of the F_2 of these crosses are given in Table III.

Here again the number of normal males is considerably above the number of normal females. This could be explained as before, that some of the chocolate males have been mistaken for normals, thus increasing the normal class and decreasing the chocolate class. Since the number in the classes of red and chocolate each fell low in their respective crosses to wild, we can expect the number in these classes to be low in this cross. Taking this fact into consideration, the ratio can be considered a 1:2:1 ratio and gives indication of linkage between the two characters. No red-chocolate double recessives were found, therefore the two mutations may be interpreted as being located in the same chromosome.

TABLE III
F₂ OF RED × CHOCOLATE CROSS

Red ♂ × Chocolate ♀

Culture Number	Type of Mating	Normal		Red		Chocolate		Total Normal	Total Red	Total Chocolate
		♂	♀	♂	♀	♂	♀			
450.	1 pair	237	206	95	122	86	92	443	217	178
451.	" "	149	132	70	56	56	48	281	126	104
452.	" "	212	184	78	108	73	83	396	186	156
453.	" "	207	186	86	85	70	93	393	171	163
455.	" "	246	238	114	129	88	106	484	243	194
456.	Mass	373	360	149	153	85	109	733	302	194
Total.		1,424	1,306	592	653	458	531	2,730	1,245	989

Red ♀ × Chocolate ♂

457.	1 pair	232	178	21	22	41	72	410	43	113
458.	" "	173	163	62	68	48	59	336	130	107
459.	" "	214	178	79	66	66	60	392	145	126
460.	" "	186	179	93	99	50	58	365	192	108
461.	" "	243	249	94	117	90	94	492	211	184
462.	Mass	370	326	121	156	90	129	696	277	219
Total.		1,418	1,273	470	528	385	472	2,691	998	857
Grand total.		2,842	2,579	1,062	1,181	843	1,003	5,421	2,243	1,846

Since mutations have occurred in eight species of *Drosophila* it seems probable that mutations may be found in all the members of this genus. As to the frequency of mutations, there may be individual variation. The writer's own experience would indicate that mutations occur less frequently in *busckii* than in *ampelophila*, for, during the same period in which the two *busckii* mutations were found, a smaller number of *ampelophila* were examined less critically and six mutations were found.

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